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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 693

Joint Contribution from the Office of Farm Management
W. J. SPILLMAN, Chief
and
Bureau of Plant Industry
W. A. TAYLOR, Chief

Washington, D. C. ▼ July 16, 1918

FARM PRACTICE IN GROWING SUGAR BEETS FOR THREE DISTRICTS IN UTAH AND IDAHO, 1914–15

(A detailed study of field operations and current cost factors involved in the production of this crop in 1914–15 on 173 farms in the Provo and Garland districts, Utah, and the Idaho Falls district, Idaho)

By

L. A. MOORHOUSE, Agriculturist, and T. H. SUMMERS and R. S. WASHBURN, Scientific Assistants, Office of Farm Management; and JAMES W. JONES, Agriculturist, Office of Sugar-Plant Investigations, Bureau of Plant Industry

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

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Joint Contribution from the Office of Farm Management,
W. J. SPILLMAN, Chief, and the Bureau of
Plant Industry, W. A. Taylor, Chief.

Washington, D. C. **PROFESSIONAL PAPER** **July 16, 1918**

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By L. A. MOORHOUSE, *Agriculturist*, and T. H. SUMMERS and R. S. WASHBURN, *Scientific Assistants, Office of Farm Management*, and JAMES W. JONES, *Agriculturist, Office of Sugar-Plant Investigations, Bureau of Plant Industry.*

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The data presented in this bulletin are based upon 173 farm estimates. Three typical districts are represented in this study, namely, Provo, in Utah County, Utah; Garland, in Boxelder County, Utah; and Idaho Falls, in Bonneville County, Idaho. The observations which were made are directly applicable to the crop years 1914 and 1915. At Provo and Garland practically all of the farmers who gave estimates during the year 1914 also contributed information for the crop year beginning April 1, 1915.

SUMMARY OF RESULTS.

The most important differences in the field practice employed in the three areas studied were found in such operations as manuring, plowing, disking, harrowing with the spring-tooth, cultivating (some using a 1-man-1-horse crew and others a 1-man-2-horse crew) and performing the hand labor (some utilizing the available farm help while others had this done on a contract basis).

There was a direct relation between the distance the beets were hauled and the cost per ton for marketing.

The total costs presented in this bulletin are based upon the production of 1,461 acres of sugar beets in the Garland area, 833 acres of beets in the Provo district, and 735 acres of beets in the vicinity of Idaho Falls. The average beet yields for these acreages varied from 13 and a fraction tons at Idaho Falls to approximately 15 tons for the Provo and Garland districts.

Labor costs constituted 54.4 to 58.3 per cent of the total expense of production on the farms visited in this study. This included all man-and-horse labor; also the contract labor. The next largest item was interest on investment in land, which approximated 23.3 per cent of the total costs in the Garland area, 25.5 per cent at Provo, and 21.1 per cent at Idaho Falls.

The total cost of production per acre was $69.03, or $4.65 per ton, for the Garland growers; $69.59 per acre, or $4.65 per ton, for Provo; and $62.68 per acre, or $4.60 per ton, for Idaho Falls.

The total credits per acre were $74.40 at Garland, $74.20 at Provo, and $69.46 at Idaho Falls, thus giving a profit of $5.37, $4.61, and $6.78 per acre for the respective areas. The estimated value of the beet tops was included in these credits.

In the Garland and Provo areas sugar-beet production proved to be the most important enterprise of the farms that were visited. Over 40 per cent of the total farm receipts were secured from the sale of sugar beets. At Idaho Falls sugar beets and potatoes were of about equal importance.

The facts brought out in this study indicate that yield per acre is an essential factor in reducing the cost per ton and consequently in increasing profits. Any change in the system of farm management that will contribute to increased yield without materially increasing the cost of production should receive the consideration of the grower.

A study of the returns on these farms emphasizes the fact that a large number of operators did not have a margin of profit after allowance had been made for all expenses connected with the production of this crop, including interest on investment.

OBJECT.

This investigation was undertaken for the purpose of making a study of the methods of farm practice which have been adopted in a few of the more important areas where the sugar beet has come to occupy a paramount place in the cropping system. Some preliminary observations were made in these areas during the years 1910 and 1911. The work at that time was confined entirely to farm-practice studies. Cultural information was sought with a view to offering suggestions for a few districts where the beet growers were experiencing difficulty in producing satisfactory yields. Subsequently it was felt that information of this character would be of value in planning agronomic experiments that would have a direct bearing upon some of the more urgent problems engaging the attention of the beet grower. The field practice of one district has features which can be adopted with profit in another, and if enough farms are studied many general questions with reference to soil and crop management can be answered. This project was organized not only for the acquirement of information relating to the production of sugar beets, but it was also developed in such a way as to provide growers with an adequate statement concerning the labor requirements of the crop. With these data available, a fair average cost of producing sugar beets in these three districts has been determined.

In working out the cost figures, the man labor was calculated by using an average rate per hour, the latter being based upon the actual wages paid in 1914 and 1915. In order to place all records on the same basis, no account has been taken of the compensation for supervision of the farm business. The work of each operator has been charged against the crop as if some person had been hired to do each task. Likewise, the horse-labor cost was computed on the basis of the average price paid by farmers in the respective districts.

Costs reported are applicable to the years 1914 and 1915. In order to bring the various items down to date, the hours of man and horse labor should be multiplied by the prevailing man and horse rates; likewise, necessary changes should be made where increases or decreases have occurred in cost of materials, use of land, or other costs.

PROCEDURE.

The survey method was adopted in procuring the records that supply the data for this discussion. A schedule was prepared to meet the requirements of the investigation, and these blanks were used by well-trained enumerators who visited the grower and obtained careful estimates covering the business of the farm for the preceding year. The operator was also asked to describe the implements that were employed in handling the beet crop. Furthermore, statements were obtained concerning the size of the crew and the normal time required in performing the various operations. The individual record was therefore compiled by setting down answers to a series of questions dealing particularly with the problems of sugar-beet production. Although very few men keep actual records of the daily work on the farm or of the business transactions which are made from time to time, it has been found that an analysis of a suitable number of farm estimates provides material that indicates the trend of affairs in such a group and conclusions which may be drawn therefrom can be regarded as significant.

COOPERATION.

In developing and projecting these studies the Office of Farm Management worked jointly with the Office of Sugar Plant Investigations of the Bureau of Plant Industry. Acknowledgment is due the farmers in these districts who gave willingly of their time in order to furnish careful estimates with reference to their methods of preparing the soil, planting, cultivating, irrigating, and harvesting the sugar beet. These men also gave information relating to the acreage and yield of the crops grown on the individual farms. The crop sales were given, and it was therefore possible to determine the relative importance of the sugar beet in these systems of farming. Each operator also reported the live stock on hand at the beginning and at the end of the farm year, and a statement was made showing the sales of live stock during the year. The relation of animal industry to beet production may be seen in these estimates. In all of these phases the growers cooperated heartily.

AREAS STUDIED.

Three distinct areas were included in this survey (see fig. 1).

In Utah County, near Provo, Utah, 21 reports were taken for 1914, and 37 farm records were obtained in the same area in 1915. Utah County has been an important beet-producing center for several years. The manufacture of sugar had its beginning in this State as early as 1852, but this pioneer venture did not prove successful. It remained for the farmers of Utah County to demonstrate at a later date the value of the sugar beet as a cash crop. The past 30 years have witnessed the development of an exceedingly important industry for farmers living within the Salt Lake Basin and contiguous territory. In Boxelder County 39 records were obtained for 1914, and to these 40 were added for the crop year 1915. The farms which were visited lie adjacent to Garland, Utah; hence, in this discussion, the name of this town is sometimes applied to the district. A beet-sugar factory was built at Garland in 1903. At present Boxelder County leads all other counties in Utah in the number of acres planted to sugar beets.

The third district in this series furnished 36 records. These farms were located in Bingham and Bonneville Counties, near Idaho Falls, Idaho. The observations on this area were confined to the year 1915. The sugar factory at Idaho Falls, Idaho, was constructed in 1903; thus the beginning of the industry in this area corresponds with the initial work in beet production at Garland.

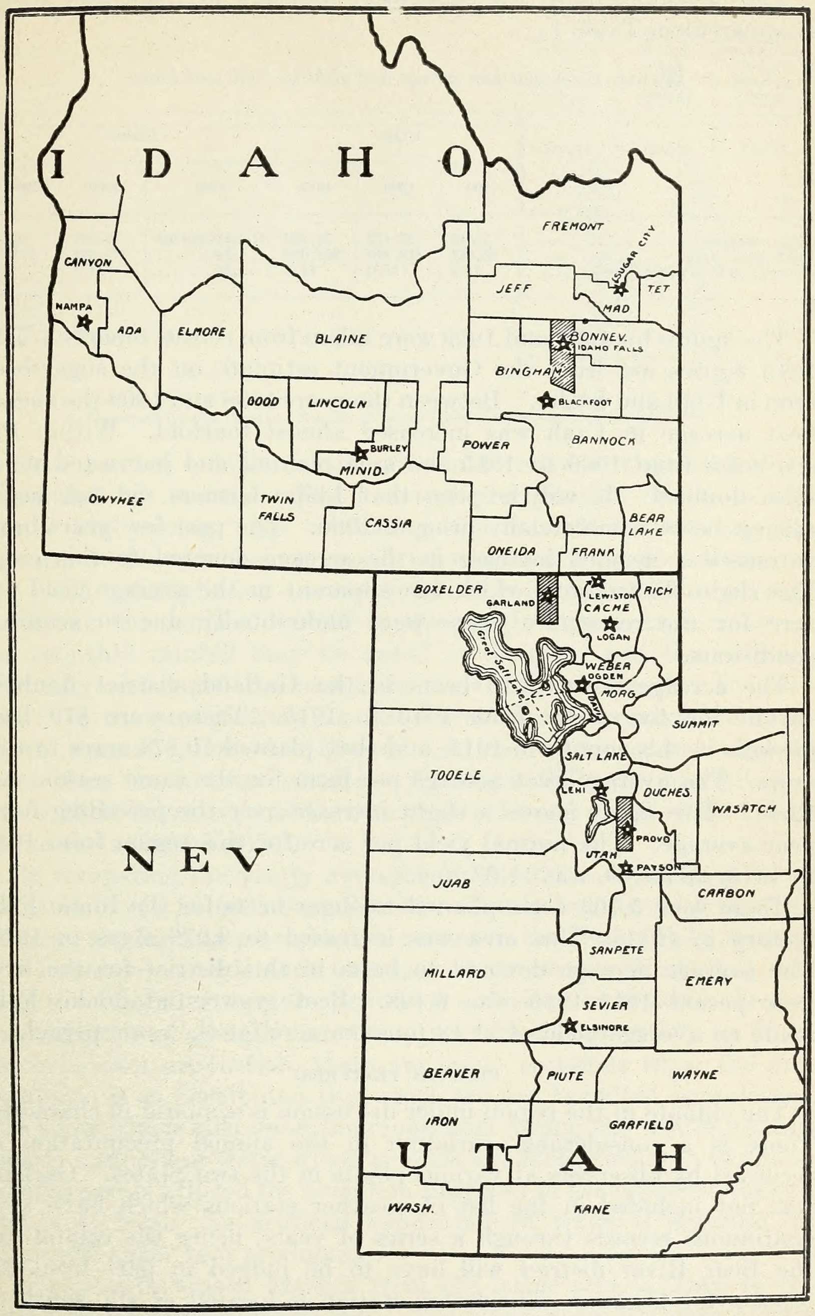

FIG. 1—Shaded areas on map indicate the three districts which were selected for this study. The stars represent the locations of the beet-sugar factories that were in operation during the years 1914 and 1915.

The development of the sugar-beet industry in Utah and Idaho is apparent in Table I.

TABLE I.—*Sugar-beet acreage and yield in Utah and Idaho.*

	Utah.			Idaho.		
	1899	1909	1915	1899	1909	1915
Total acreage	7,546	27,472	59,400	None reported.	15,601	35,900
Production (tons)	85,914	413,846	691,000	do	179,661	375,000
Average yield per acre (tons)	11.4	15.0	11.6	do	11.5	10.4

The figures for 1899 and 1909 were taken from census reports. The 1915 figures are from the Government estimate on the sugar-beet crop in Utah and Idaho. Between the years 1898 and 1909 the sugar-beet acreage in Utah was increased almost fourfold. Within the six years from 1909 to 1915 the area planted and harvested more than doubled. It will be seen that Idaho farmers did not begin raising beets commercially prior to 1900. The past few years have witnessed a decided increase in the acreage devoted to this crop. The slight fluctuations which are apparent in the average yield per acre for the respective years were undoubtedly due to seasonal conditions.

The acreage devoted to beets in the Garland district doubled within the five years from 1910 to 1915. There were 879 beet growers in this county in 1915, and they planted 10,874 acres to this crop. The average beet acreage per farm for the same season was 12.37. This figure shows a slight increase over the preceding four-year average. The normal yield per acre for this region from 1911 to 1915, inclusive, was 11.53 tons.

There were 5,763 acres planted to sugar beets for the Idaho Falls factory in 1911. This area was increased to 8,076 acres in 1915. The average acreage devoted to beets in this district for the five-year period 1911–1915 was 6,198. Beet growers at Idaho Falls made an average yield of 11.18 tons per acre for the same period.

CLIMATIC FEATURES.

The climate in the region under discussion is semiarid in character. There is a considerable variation in the annual precipitation as recorded by observers at various points in the two States. Garland was not included in the list of weather stations which have kept continuous records through a series of years, hence the rainfall for the Bear River district will have to be judged in part from the reports for Corinne The latter station is located at the southern end of the Bear River Valley The average precipitation for Boxelder and Utah Counties, Utah, and Bingham County, Idaho, for a period of years will be found in Table II.

TABLE II.—*Average rainfall by months for 2 districts in Utah and 1 in Idaho.*[a]

	1870–1909, Corinne, Utah, Boxelder County.	1892–1909, Provo, Utah, Utah County.	1881–1908, Idaho Falls, Idaho, Bingham County.
	Inches.	*Inches.*	*Inches.*
January	1.37	1.47	1.59
February	1.24	1.46	1.32
March	1.42	1.65	2.03
April	1.12	1.28	1.16
May	1.44	1.83	1.62
June	.59	.66	1.41
July	.45	.42	.53
August	.59	.75	.82
September	.67	.81	.63
October	1.02	.91	1.02
November	1.05	1.08	1.08
December	1.55	1.39	1.30
Total	12.51	13.71	14.51

[a] Reported by the Weather Bureau, United States Department of Agriculture.

These records exhibit considerable uniformity in the distribution of rainfall by months. The heaviest precipitation occurs in the winter and spring. By combining the rainfall for the months January to May, inclusive, it will be seen that fully 50 per cent of the yearly precipitation occurs within this period. Under average conditions the summer rainfall is exceedingly light. An increase in the monthly rainfall may be noted in October, and this average gradually rises until the maximum is reached in March. In 1914 and 1915 the precipitation for the Provo district was considerably above normal. Boxelder County had for both seasons slightly more than the average rainfall. At Idaho Falls the precipitation was a little below normal for the year 1914 and more than 1 inch above the normal for 1915.

By comparing the yearly averages for the three districts, given in Table II it will be seen that Boxelder County has the least rainfall, whereas the highest precipitation occurs in the Idaho Falls district. The increases coincide with increases of elevation. While it is true that the rainfall at certain periods is sufficient to moisten the soil thoroughly, and at such times may provide enough water to be of value in crop production, there are many occasions when the precipitation is so distributed that crops are not benefited appreciably. The snow which falls upon the mountains during the winter months affords a supply of water which is made available during the summer months and is utilized for irrigation purposes in the adjacent valleys. For most farms the artificial application of water is essential for successful sugar-beet production.

The growing season extends from the latter part of April to the first or second week in October. The latest dates for spring frosts throughout this period varied from April 19 to May 28. In the autumn there was a variation from September 15 to October 18 in the earliest frost dates for Utah. The season at Idaho Falls is probably somewhat shorter than the period indicated for the lower elevations. The Idaho Falls district not only has a higher elevation than the other two, but this area is also some distance farther north than Utah or Boxelder Counties.

SOILS.

The farms included in this study were located largely on four distinct soil types. Fortunately, the Bureau of Soils had classified considerable areas in the three districts selected for these observations. In so far as these records are concerned, the Jordan loam is the most important soil type in the Provo and Garland sections. This type has been described as loamy in character, having a depth of 3 feet, and being underlaid with a stiff, tenacious clay. It is essentially a heavy soil and requires more than an average amount of work to maintain the proper tilth. It is well suited, however, to the production of sugar beets. A few records were taken on Maricopa gravelly loam below Provo. Likewise a small number came from Malade fine sandy loam south of Garland. At Idaho Falls the Yakima loam is the prevailing type. This soil was built upon gravelly loam or water-worn gravel. It is stated that the Yakima loam is easily tilled, loose in texture, and bakes very little on exposure after irrigation.[1]

SIZE OF FARM IN RELATION TO BEET ACREAGE.

A few of the 1914 estimates were taken on farms producing less than 5 acres of beets. The enterprise records for 1915 were confined almost entirely to farms producing 5 or more acres of beets. It was felt that the man who was growing less than 5 acres of beets would not be prepared to give reliable information on field operations, such as harrowing, rolling, floating, cultivating, etc., because the 2 or 3 acre field does not provide sufficient area to keep the crew employed for any considerable length of time, hence the operator would not have the necessary foundation upon which to build his estimate concerning a day's work. All of the counties represented in this study contain a relatively large number of small farms, many of these units not planting more than 3 or 4 acres to sugar beets. A study of Table III will give the reader some idea as to the size of the farms in the four counties represented in this survey. These figures were taken from the Thirteenth United States Census Report. The table also contains a classification of the farms which were included in this survey.

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[1] This paragraph is based upon work done by U. S. Department of Agriculture, Bureau of Soils: Soil Survey, Provo Area, Utah, 1903; Soil Survey, Bear River Area, Utah, 1904; and Soil Survey, Blackfoot Area, Idaho, 1903.

TABLE III.—*Number of farms of specified sizes in 1910 in Boxelder and Utah Counties, Utah, and Bingham County, Idaho; also number of records secured in these counties, 1914–15.*

Size.	Utah County.		Boxelder County.		Bingham County.		Fremont County.
	Number of farms in 1910.	Records secured in 1914–15.	Number of farms in 1910.	Records secured in 1914–15.	Number of farms in 1910.	Records secured in 1914–15.	Number of farms in 1910.
9 acres and under	318	....	83	....	63	....	53
10 to 49 acres	1,530	20	450	24	472	11	445
50 to 99 acres	500	17	281	29	582	12	594
100 to 174 acres	283	17	303	14	790	12	1,372
175 to 259 acres	98	3	122	5	191	1	236
260 to 499 acres	96	1	161	5	145	....	293
500 to 999 acres	29	....	77	2	38	....	75
1,000 acres and above	19	....	50	....	6	....	23
	....	58	....	79	....	36	....

Utah County especially shows a large number of farms under 9 acres; the second group, 10 to 49, contains more than one-half of the farms in this county. The settlement of some of these districts dates back to 1848–1850, and as the practice at that time favored the smaller units it is not surprising to find a large number of such tracts at present. There is a more uniform distribution throughout the various group sizes in Boxelder County than in Utah County. It should be observed that Boxelder County has a much larger land area than Utah County, and as a large part of this excess is known as dry land, it has made necessary the development of many more farms of the larger sizes. The Idaho districts have been developed within more recent years, and although there is here also a tendency in the direction of the smaller units, farms containing a quarter-section (160 acres) are much more common than in the Provo district.

The small farm frequently is cultivated somewhat more intensively than the large farm. Fruit growing is an important enterprise on these tracts. Some farmers give attention to the production of truck crops. On farms of practically all sizes the supplies for the household are not overlooked. Fresh fruit and vegetables are therefore available for the home table.

RELATION OF BEET ACREAGE TO IRRIGATED AREA.

Sugar beets can be grown profitably in the region of this study only on that part of the farm which can be supplied with water artificially. Therefore it is important to know what proportion of the irrigated land is occupied annually with this intertilled crop.

TABLE IV.—*Average acreage per farm, total tillable, irrigated, and in beets, 1914–15.*

District.	Number of farms.	Acres per farm.	Acres tillable.	Acres irrigated.	Acres in beets.	Per cent of irrigated land in beets.
Provo	58	86.55	48.95	41.20	14.36	34.9
Garland	79	104.71	83.00	44.04	18.49	42.0
Idaho Falls	36	91.08	78.54	78.32	20.40	26.0

Practically all of the tillable area on the farms in the Idaho Falls district was under irrigation. (See Table IV.) About 84 per cent of the tillable area on the farms in the Provo district was under ditch. while the Garland farms showed only 53 per cent. A much higher percentage of the irrigated land was devoted to beets at Garland than in the case of the Idaho Falls and Provo farms.

COMPARISON OF FARM ESTIMATES WITH FACTORY RECORDS.

Each sugar factory keeps a record of the acres planted to sugar beets on each farm. The various tracts are measured by the field man, and the planted as well as the harvested acreage is definitely established. At the end of the growing season the product from each field is carefully weighed, and the grower is provided with a scale record showing the actual tonnage harvested. These figures, compiled by the factory, show not only the yield per acre for each farm, but also the average yield for the total acreage harvested. In a study of this character it is therefore possible to check the grower's estimate on acreage, yield, and receipts for the sugar beet with the actual acreage, yield, and receipts as shown by the factory accounts. The estimates which obviously contained grave mistakes were discarded, and the reliable figures made available for the analytical study were used. (See Table V.)

TABLE V.—*A comparison of growers' estimates with factory record,*[a] *average acreage, yield, and return per acre per farm, 1914–15.*

District.	Number of farms.	Acres in beets.		Yield per acre.		Cash return per acre.	
		Estimated.	Factory.	Estimated.	Factory.	Estimated.	Factory.
Garland	79	18.49	18.31	14.85	14.80	69.82	68.66
Provo	58	14.36	14.70	14.96	13.64	69.40	70.34
Idaho Falls	36	20.40	20.7	13.62	12.02	69.47	61.40

[a] See Department Bulletin No. 529, "The Validity of the Survey Method of Research."

In the Garland district the average estimated acreage per farm was 1.06 acres greater than the factory record. There was not much difference in the average yield for the same area, and the cash returns per acre are not far apart. The Provo district shows a very striking correspondence in the acreage and cash returns, but there is a slight difference in the yield per acre reported by the two methods. The Idaho Falls records indicated some variation in the yield per acre, and this is reflected in the cash return per acre. Fewer estimates were obtained in the Idaho Falls area than in either of the other districts.

METHOD OF PRESENTING DATA.

The subject matter in this bulletin was prepared in two parts. The first section deals with the major and minor operations performed by the Utah-Idaho growers in producing the 1914 and 1915 beet crops. Each operation is treated separately. While the farm practice studies as a whole are applicable to 173 estimates, the different methods which are described are not all followed on all farms. Plowing, cultivating, and harvesting were operations common to all records, but the soil tillage subsequent to plowing varied considerably. This was true not only with such work as harrowing, disking, leveling, and rolling, but it was also noticeable in the management of the hand labor. In presenting the farm-practice data the district was taken as the unit, and the results have been compiled so as to show the average crew, average labor requirements, and average cost per acre for each of the three areas studied.

The second part of this bulletin includes a study of the total cost of production. Here the total cost of man labor and horse labor, the total expense connected with the purchase of materials, and all other costs, are combined for the purpose of showing the actual cost of producing an acre or a ton of sugar beets on the fields which were cultivated by these growers. The different costs are distributed over the entire beet acreage for these farms. The practice sheets show the actual acreage covered, and the labor requirements as well as the acre charge are worked out on this basis. When the cost for each of these items is charged against the entire beet crop, a lower figure is shown. As a matter of fact, the entire crop must bear any expense that may apply to a part of the acreage.

CROP ROTATION.

The question of rotating the farm crops has been given some attention in the Provo, Garland, and Idaho Falls districts. While it is true that there are some farms in each area where individual crops are grown continuously upon the same land, the value of systematic cropping has been recognized in each district, and several fairly definite plans may be found in actual practice. Some men are limited by the number of crops which may be grown under their individual conditions, consequently they do not have an opportunity to give the land a change at frequent intervals. Some farms contain dry land as well as irrigated land; the dry land is almost of necessity devoted to the production of grain exclusively, whereas the irrigated land is set aside for alfalfa, sugar beets, and truck or garden crops. It will be seen that this arrangement makes it impossible for some of these men to use grain at regular periods in rotation with sugar beets. Each crop has its adaptations, and these characteristics must be taken into account in planning the work of the farm. With this situation facing the grower, there is a natural tendency to allow sugar beets to follow beets upon the same field for several years; likewise, the hay crop is not disturbed for a comparatively long period.

Alfalfa is regarded as an essential crop in all of the rotations which were suggested. It is usually seeded along with grain, although occasionally it may be started without a nurse crop. After a stand has been obtained, the field is cropped annually for periods ranging from three to eight years. It is quite a common practice to leave the alfalfa for four to five years. Three to four cuttings are made per season, and the yields vary from 3 to 5 tons per acre each year. Generally speaking, the greater part of the hay is fed upon the farm. In the Provo and Garland districts the alfalfa weevil has damaged the crop seriously in recent years. This insect appears to work extensively upon the first crop, and if its activity is not checked the second crop may be shortened materially. When much damage is suspected, cultivation is recommended. This treatment has proven to be effective in averting a loss which would otherwise occur.[1]

The Provo estimates indicate that alfalfa is grown upon the same piece of land for about five years. After breaking, grain was sown the first year on approximately 50 per cent of the farms which were visited. In a few cases grain was used for two years after plowing up the alfalfa. The sugar beet sometimes follows alfalfa, though this is not considered good management, because the alfalfa roots interfere to quite an extent with the early cultivation of the young beets. The use of grain immediately after plowing up the alfalfa gives the grower a chance to subdue the latter crop in part, and the soil can be tilled the subsequent season without pulling out or damaging the sugar beets. The potato was reported in four rotations, following grain in three cases, and coming after sugar beets on the fourth farm. However, the potato does not figure here as an important crop, doubtless because potato diseases have damaged the crop appreciably within the last two or three years. The rule seems to be to plant beets after a crop of grain, which means the second year after breaking, then beet culture is continued for five years or more on the same ground. On a few farms the beet has been grown continuously for periods of 10, 12, and even as high as 18 years.

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[1] Farmers' Bulletin 741, "Alfalfa Weevil and Methods of Controlling It."

About one-third of the men who were consulted in this area stated that a definite cropping system had not been adopted as yet, but these operators were prepared to give suggestions with reference to the length of time alfalfa is allowed to remain down. Continuous beet culture appeared to be the practice on this group of farms.

There is quite a marked similarity between the methods of cropping that prevail in the Provo and the Garland district. On the farms of the latter area the average period through which the alfalfa sod remains unbroken is about five years. Planting grain for one or two years after plowing up the hay crop provides the connecting link between the alfalfa and the sugar beet. The potato enters into the general plan on relatively few farms. The sugar beet is the chief money crop, and naturally occupies a conspicuous place in the rotation. Fully one-half of the growers in this area reported that sugar beets had been grown for five years or more on the same part of the farm. This practice is no doubt due in part to the prevailing opinion that beet land improves from year to year. Many growers contend that they are getting better yields now in fields which have produced eight crops or more than they were able to obtain during the first two or three years of their experience. There is a tendency to overlook the changes which have been made in the methods of culture. The increased yields, if there is such an increase, are undoubtedly due to greater efficiency in producing the crop. It is not unusual to find beets following beets upon the same field 8 to 12 years without the introduction of any other crop. Such a system invites trouble and consequent shortage in yield through the development of plant diseases or the multiplication of insect pests. A few have recognized the serious possibilities of such a situation and are endeavoring to modify this well-established practice. About 33 per cent of the Garland records show that a definite crop rotation has not been fully established. When apple and other orchards are being developed, it is a common practice to grow sugar beets on this land.

There are portions of the Idaho Falls area where the potato is the only cultivated crop and practically no attention is given to the production of sugar beets. For these farms a slightly different rotation has been evolved. The Idaho Falls rotation, which includes alfalfa, potatoes, beets, and grain, is in conformity with the Utah method of cropping. However, under average conditions alfalfa is broken out at the end of the fourth year and potatoes take the place of grain on the newly turned soil. A few operators put in grain immediately after breaking. Potatoes are planted the succeeding year. Beets follow beets for two or three years, after which grain is sown and alfalfa is established once more. Occasionally potatoes are planted for two or three years consecutively after breaking, and beets come the fourth and fifth years. This practice did not appear to be very common. A few men have used the sugar beet on the same field for 7 to 10 years without introducing any other crop.

The following may be cited as typical rotations for the areas surveyed:

Provo and Garland areas:
  Alfalfa, 5 years.
  Grain, 1 year.
  Beets, 5 years or more.
  Grain, 1 year.
    Reseed to alfalfa.

Idaho Falls area:
  Alfalfa, 4 years.
  Potatoes, 1 year.
  Beets, 2 and 3 years or more.
  Grain, 1 year.
    Reseed to alfalfa.

VALUE OF MAN LABOR AND HORSE LABOR.

Each farmer furnished an estimate not only of the value of his own labor on the farm, but also of wages paid out for regular and extra labor. In addition, a record was obtained covering the value of horse labor. These rates were tabulated, and the averages derived were as follows:

Man rates and horse rates per hour.

	Boxelder area.	Utah area.	Bonneville and Bingham area.
Man	$0.20	$0.19	$0.20
Horse	.09	.10	.10

There is very little difference in the average rates per hour for man labor and horse labor in these three districts. The customary rate for man labor appeared to be 20 cents per hour, or $2 per day, while the usual charge for horse labor was approximately 10 cents per hour, or $1 per day. The seasonal variation for the first two districts in 1914 and 1915 was so small that the rates worked out for the first season were adopted for the second. This applies to two counties in which records were taken for 1914 and again in 1915. The value of both man labor and horse labor fluctuates from year to year, owing to changes in the rates that are paid.

The labor requirements of any crop do not change as readily as the cash rates per hour or day, hence in discussing the various topics included in this paper special attention has been given to the hours of man labor and horse labor required for each operation. Beet growers are quite familiar with the dollar method of presentation; consequently, money values have been assigned in writing this bulletin. The labor requirements of this crop are also given. Thus, if a change is effected in the labor rates, a few simple calculations will enable the reader to obtain the corresponding value showing the cost per acre or per ton.

FARM PRACTICE IN THE PRODUCTION OF SUGAR BEETS AND RELATED COSTS.

SCRAPING THE FIELD.

The preparation of the seed bed for any cultivated crop grown under irrigation frequently demands some special attention in order to insure a uniform and rapid distribution of water when the proper season arrives. An uneven surface interferes with the run of water and prevents a portion of the field from receiving the amount which is required by the crop to produce an average yield. It is the custom in several of these districts to level the cultivated area with a Fresno scraper (fig. 2). Ordinarily a few days are spent during the fall and winter months with a team and a scraper at this particular task. It was decided to consider this as improvement work, and although a small amount of man labor and horse labor is shown on some of these records, no charge for scraping was made against the beet crop. As a matter of fact, this expense should be distributed through a series of years, and this process, if followed, would render the cost for a single crop season practically negligible. It may be stated that the analysis shows a variation in cost from $1.55 to $2 per acre for scraping. Such work merely adds to the farm capital, and any cost incident thereto can eventually be applied to the various enterprises of the farm as interest charge.

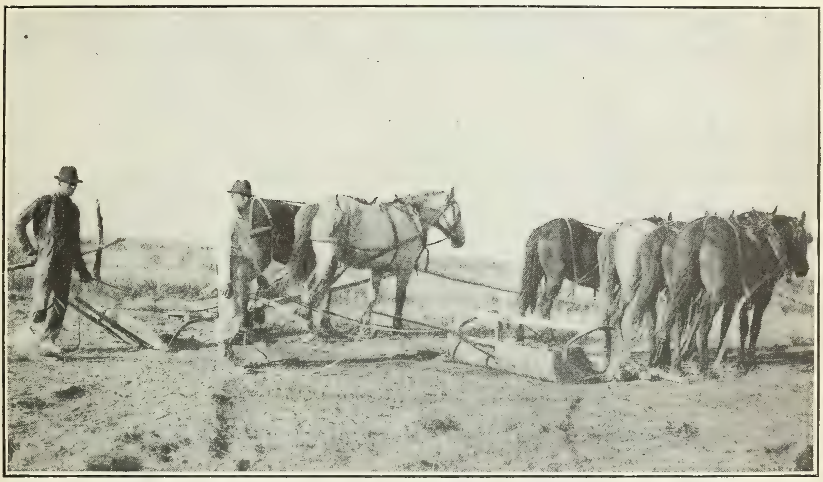

FIG. 2.—Typical crews employed in scraping the field preparatory to plowing. This is done for the purpose of making the surface level for irrigation. In this study scraping was considered as improvement work.

MANURIAL PRACTICE.

Farm manure is regarded as an important by-product of the farm in the beet districts of Utah and Idaho. Of the men who were interviewed, 93.6 per cent had applied manure to the land the preceding season and gave estimates of the value of the manure in the yards as well as of the total time required to haul this by-product to the field. (See Table VI.) It is the general practice to utilize practically all of the manure available on the farm, and occasionally the operator supplements the home supply by hauling from a near-by feed yard or livery barn. Our records show that from one-third to one-half of the beet land was treated with an annual application of farm manure. Without exception the sugar beet gave evidence of direct benefit from the application of manure. In most cases the manure was hauled from the yard to the field in wagons and scattered by hand. In the Provo group the manure spreader was used by 41 per cent of the operators. The hauling was done almost entirely during the winter and early spring months. There is no other work to engage the attention of the farmer at this season of the year, which may explain the common practice of hauling with a wagon. He has plenty of time in which to complete the task, and an investment in a manure spreader has seemed to be unnecessary. To the same reason may be attributed the relatively small crew assigned to this task. On a majority of the farms this operation was done by one man with two horses and a wagon. Where the spreader takes the place of the wagon three horses are usually employed, and frequently an extra man assists with the loading.

Farm manure was sometimes applied to the potato land. Sugar beets were then grown the following year. The claim is made that manure often contains a large number of weed seeds, which germinate and interfere to a considerable extent with beet culture. If manure is scattered on potato land, the noxious weeds appear largely the first season and can be eradicated much more readily.

Table VI.—*Manurial practice.*

District.	Year.	Number of farm records.	Acres manured per farm.	Tons applied per acre.	Average crew.		Hours per acre.		Labor cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	74	6.9	20.2	1.4	2.48	21.5	39.7	$7.87
Provo	1914–15	54	7.9	17.2	1.4	2.59	21.5	38.8	7.96
Idaho Falls	1915	34	10.0	15.5	1.6	2.48	19.2	34.5	7.29

The Garland farmers applied manure to approximately one-third of the beet land, the Provo operators slightly more than one-third, and the Idaho Falls growers slightly less than one-half. The application of manure varied from 15.5 tons per acre in the Idaho Falls region to 20.2 tons per acre for the Garland farms. Provo growers applied an amount intermediate between these two averages. The original estimates were procured upon the basis of the number of loads applied per acre, and the operator was then asked to give the weight of an average load as nearly as this could be ascertained. The tons applied per acre were determined from these two figures.

There was practically no difference between the Garland and the Provo group in the labor requirements for this operation. However, as has been pointed out, the rate of application varied. Viewing the problem from the latter standpoint, it may be stated that the Garland operators applied manure at a cost of 39 cents per ton, whereas the costs for Provo and Idaho Falls growers averaged 46 and 47 cents per ton for the respective areas. There was a comparatively high labor cost for hauling and distributing manure in the Provo district during the year 1915. This was shown in the average for 34 farm estimates, and it undoubtedly had some influence on the final result, which includes the findings for two seasons. It may be explained that several of the operators in this area were located some distance from the beet field, and considerable time was consumed in moving the manure from the corral to the farm. The location of the beet field with reference to the farmstead was unquestionably one of the factors that had an important bearing upon costs. It was more difficult to get the relationship of other factors, such as the size of the crew and the method of distribution.

PLOWING.

The sugar beet requires a deep mellow soil. To provide this condition it is necessary to stir the surface to a depth of 8 or 9 inches. On the average farm the land was given only one plowing, though two plowings are sometimes necessary. Plowing was repeated on a few farms in order to bring rough or uneven land into suitable condition for planting. In a few cases two plowings were essential in the preparation of alfalfa land for beets. Twelve operators in the Garland group crowned and subsequently replowed alfalfa land for beets. Crowning means breaking to a depth of 3 inches, which is just deep enough to cut the crowns of the alfalfa plants. It will be seen that crowning was a minor operation in this study. Sometimes the field was disked or harrowed immediately after breaking. When the alfalfa crowns had dried out completely, the soil was turned a second time, the plow being run at a depth of 8 to 10 inches. The crowning was done exclusively in the fall of the year. This operation was performed mainly with a crew of one man and three horses, and the ground was plowed at the rate of 1.7 acres per day. The cost was $2.75 per acre for crowning alfalfa.

Plowing is an essential step in the preparation of a first-class seed bed for beets. Occasionally some of the fields of the farm may be left in such condition that it is not necessary to plow in the spring, but as a rule this operation is performed by all growers either in the autumn or at the beginning of the next crop year. In this investigation two farmers located at Idaho Falls prepared the land and planted beet seed without plowing. These were exceptions to the general practice. A summary of the plowing practice for the remaining farms will be found in Table VII.

TABLE VII.—*Plowing practice.*

District.	Year.	Number of farm records.	Acres plowed per farm.	Average crew.		Hours per acre.		Cost per acre.
				Man.	Horse.	Man.	Horse.	
Garland	1914–15	79	18.1	1	3.3	5	16.3	$2.47
Provo	1914–15	58	14.3	1	3.2	6	18.9	3.03
Idaho Falls	1915	35	19.62	1	3.5	4.4	14.6	2.34

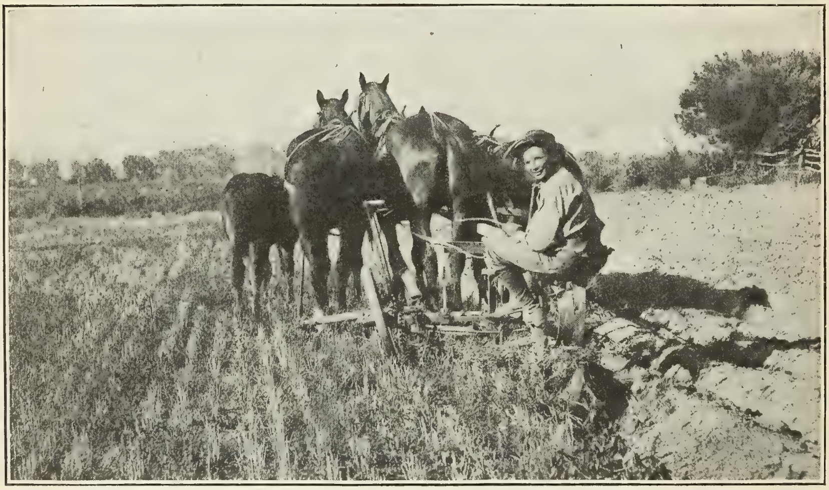

FIG. 3.—Fall plowing stubble land in Utah County, Utah. For the Provo and Garland districts this operation was performed mainly in the autumn.

The 1-furrow sulky plow with a 14-inch bottom appeared in 108 farm reports, thus indicating that this type was used very generally in these districts. Forty-one records included the 2-way plow, while 21 reports show that the soil was turned with an ordinary walking plow. A minor part of the plowing was done with two, three, and four furrow gangs. The dominant crew consisted of one man and three horses. This combination was in evidence on 121 farms. In contrast with the average figures in the foregoing table, this crew did the plowing at a cost of $2.38 per acre at Garland, $2.86 per acre at Provo, and $2.19 at Idaho Falls. The horsepower was increased to

4 in the case of 38 records. Only a few operators plowed with a 2-horse team. Idaho Falls growers plowed the beet land at the rate of 2.25 acres per day, the Garland operators averaged 2 acres per day, while in the Provo area 1.65 acres constituted a day's work. The fact that the soil is fairly heavy may have been responsible for somewhat slower work in the latter instance. The depth of plowing in the three districts varied from 8 to 10 inches.

At Garland and Provo the plowing was done mainly in the fall (fig. 3), whereas in the Idaho Falls district this work was done almost entirely in the spring. The plowing practice in the latter district especially with reference to the time of doing the work may be controlled in part by the combined potato and sugar-beet harvesting operations. Then, too, it may be observed that the Yakima loam is not a heavy type, consequently frost action is not essential in order to obtain a mellow condition. The majority of the beet growers harrowed daily all of the land newly plowed that day; in fact, many made a practice of harrowing up to the plow each half day. Under arid conditions this plan prevents undue evaporation of moisture; it also leaves the surface of the field in much better tilth, and subsequent culture can be carried out much more effectively than when the land is allowed to dry out before harrowing.

DISKING.

In the preparation of beet land the disk harrow was used on relatively few farms. The Garland group contained only 1 disk-harrow record for the year 1914 and 13 records the succeeding season. Apparently the climate conditions were less favorable in 1915 than 1914, hence more work was required to bring the soil to the proper degree of fineness, the disk harrow being selected for the extra work.

Table VIII.—*Disking practice.*

District.	Year.	Number of farm records.	Acres disked per farm.	Number of times disked.	Average crew.		Hours per acre.		Cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	14	11.86	2.93	1	3.93	2.08	8.24	$1.16
Provo	1914–15	12	12.33	2.08	1	3.25	2.24	7.33	1.16
Idaho Falls	1915	8	17.81	1.12	1	3.88	1.74	6.76	1.03
Provo, lap one-half	1915	11	13.63	1.50	1	3.36	2.93	9.72	1.53

The disking was done mainly in March and April, Thirteen out of 14 Garland growers and seven out of eight at Idaho Falls reported crews of one man and four horses, while only 8 out of 23 in the Provo district used this crew. Provo also had 14 estimates which reported crews consisting of one man and three horses. It will be observed that the records at Provo were divided into two groups. On 11 of these farms it was the practice to lap one-half in doing the disking.

It was in this group that the maximum cost per acre occurred. Under the foregoing conditions the area covered per day with the disk varied from 5 acres in the Provo district to 14 acres in the Garland section.

Occasionally it is necessary to give special cultivation in the preparation of the seed bed. This is true where the soil happens to be in poor physical condition, or infested with weeds. (See fig. 4.)

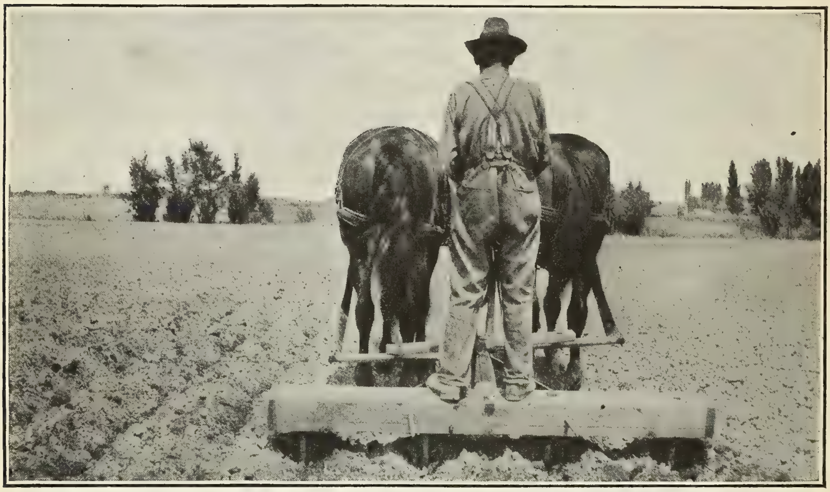

FIG. 4.—Special summer cultivation on land infested with wild oats.

LEVELING.

The leveler is almost indispensable on an irrigated farm. It is usually a homemade affair, and the original cost should not exceed the actual cash outlay for the timber which is used in its construction. It is built by placing two long planks on edge in a parallel position 7 to 8 feet apart; cross pieces similar in width and thickness are set between these two pieces, being adjusted to the proper angle. The entire framework is fastened together securely. This device is drawn over the plowed ground, usually by four horses. Although the primary object is to bring the surface to an even grade, more is accomplished than merely leveling the plowed soil. The leveler serves to break or crush many small clods, and in this way assists in pulverizing the surface. In the order of operations, leveling occupied an intermediate place between plowing and planting.

TABLE IX.—*Leveling practice.*

District.	Year.	Number of farm records.	Acres leveled per farm.	Times leveled.	Average crew.		Hours per acre.		Total cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	80	18.27	1.52	1	3.70	1.42	5.18	$0.75
Provo	1914–15	57	14.37	1.39	1	3.09	1.87	5.60	.92
Idaho Falls	1915	35	20.27	1.58	1	3.66	1.28	4.77	.74

Leveling requires a generous supply of horsepower in order to do the work efficiently. In performing this operation the dominant crew used on the farms studied consisted of one man and four horses. Ninety-three reports gave crews of this size, and the distribution shows that 57 records belonged to Garland, 14 to Provo, and 22 to Idaho Falls. The crew next in size, one man and three horses, was found in 23 Garland, 34 Provo, and 13 Idaho Falls records. Provo farmers gave nine estimates showing crews with one man and two horses. The latter district had the highest cost per acre for leveling. An average day's work with the leveler varied from 7 to 11 acres.

FLOATING.

The float is designed primarily to crush clods. It is homemade and may be placed in the same class as the leveler. It is constructed out of planks lapped one upon another, forming a beveled surface that comes in contact with the soil. The average float was about 8 feet in width. This homemade affair is often attached to the rear of the harrow, thereby pulverizing and crushing the soil in one operation. Occasionally the same result may be obtained by fastening a single plank behind the harrow. There were only 15 records which dealt with floating; 11 of these were obtained at Provo. A survey of the practice on the Provo farms indicates that the ground was gone over on an average of 1.8 times, with time consumed approximately 1.89 man hours and 4.93 horse hours per acre, and cost 85 cents per acre. At Idaho Falls the floating was done only once, at an average cost of 55 cents per acre. One special clod masher was recorded in these studies, the cost with this implement being approximately 39 cents per acre for one treatment.

HARROWING.

The harrow is an important tillage implement on every farm. It is not only used extensively in the preparation of land which is to be seeded to grain, but it also plays a very important part in the development of a suitable seed for intertilled crops. Two types were found in each section—namely, the common spike-tooth harrow and the spring-tooth harrow. Estimates were secured covering the use of each of these implements. (See Tables X and XI.)

TABLE X.—*Harrowing practice (spike-tooth).*

Distict.	Year.	Number of farm records.	Acres harrowed per farm.	Number of times harrowed.	Average crew.		Hours per acre.		Cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	78	18.8	2.82	1	3.2	2.02	6.39	$0.98
Provo	1914–15	50	14.9	2.57	1	2.7	2.6	5.50	1.04
Idaho Falls	1915	34	19.9	3.40	1	3.1	2.2	6.80	1.12

The harrowing was done during the months of March, April, and May. Under average conditions the land was harrowed approximately three times with implements about 10 feet in width. The typical crew consisted of one man and three horses. This size was given for 95 out of 162 estimates. A crew of one man and four horses was second in importance, appearing in 35 records. There were 31 reports which contained information on the use of 1-man 2-horse crew. Nineteen of these were in the Provo district. In this area about 10 acres were considered a day's work with the spike-tooth harrow. The Garland growers averaged about 14 acres per day, while at Idaho Falls 15 acres was the average area covered in 10 hours. Only a few farmers at Idaho Falls used the spring-tooth—a fact which undoubtedly accounts for the greater use of the spike-tooth in comparison with the Utah districts.

TABLE XI.—*Harrowing practice (spring-tooth).*

District.	Year.	Number of farm records.	Acres harrowed per farm.	Number of times harrowed.	Average crew.		Hours per acre.		Cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	35	17.9	1.60	1	3.48	1.76	6.08	$0.90
Provo	1914–15	29	11.05	1.77	1	2.89	2.50	7.20	1.20
Idaho Falls	1915	7	11.40	1.80	1	3.70	1.74	6.30	.98

Spring-tooth harrowing was reported in 71 farm records, the majority of these being divided about equally between the Garland and Provo districts. Comparing the work done with the spring-tooth with that done with the spike-tooth harrow, it will be observed that the fields were not gone over so frequently with the spring-tooth. The average width of the latter was about 6½ feet. Forty-six records gave a crew of one man and three horses. In the Garland area 18 reports were based upon a 1-man and 3-horse crew, while 17 were applicable to a 1-man and 4-horse crew. Provo farmers covered about 7 acres per day with this type of harrow, while the Garland operators averaged 9 acres.

ROLLING.

At Garland one-half of the rolling was done during the early part of May. A study of the records shows that a part of the rolling preceded planting by a few days, sometimes coming on the same day as the planting. Manifestly the roller was run over the fields at this time for the purpose of creating a smooth, even surface for the drill. In order to get straight rows, the driver must see the trail which has been left by the marker, and this line can be distinguished most readily on a newly rolled field. Under certain conditions, the roller may be operated for the purpose of breaking down a cloddy surface. Such work usually accompanies other tillage operations, such as harrowing and leveling. The roller may be utilized after the seed has germinated and the young plants are pushing through to the surface. This operation is known as "rolling beets." Light showers may cause a crust to form on the surface, and if this be permitted to develop fully the small plants may have difficulty in reaching the light. Under such conditions rolling sometimes breaks the crust and insures a better stand. Rolling before cultivation facilitates the latter operation, and undoubtedly aids in removing small obstructions such as soil lumps that interfere with blocking and thinning. (See Tables XII and XIII.)

TABLE XII.—*Rolling practice.*

District.	Year.	Number of farm records.	Acres rolled per farm.	Hours per acre.		Cost per acre.
				Man.	Horse.	
Garland	1914–15	31	16.8	0.74	1.5	$0.29
Idaho Falls	1915	6	22.8	.62	1.47	.27

Rolling before planting occurred on 37 farms. At Garland the beet land was rolled one and one-third times, and 15 acres were covered daily at a cost of 29 cents per acre. The crew for all farms consisted of one man and two horses.

TABLE XIII.—*The practice of rolling beets.*

District.	Year.	Number of farm records.	Acres rolled per farm.	Hours per acre.		Cost per acre.
				Man.	Horse.	
Garland	1914–15	29	16.8	0.71	1.43	$0.27
Provo	1914–15	18	13.1	.69	1.39	.27
Idaho Falls	1915	12	19.2	.62	1.25	.25

The crews for rolling beets were the same as those used in the preceding practice. A day's work rolling beets varied from 14 to 16 acres. Thirty-four per cent of the farm records included rolling beets as a part of production. Where rolling follows the thinning, the soil is made firm about the young plants, and it is stated by some who are familiar with beet culture that this practice promotes growth.

DITCHING.

A certain amount of ditch cleaning must be done annually on an irrigated farm. This may include work on the lateral which carries water from the main canal to the farm proper, or it may take into account the removal of silt and other débris from the distributing laterals on the farm. Whatever work is done should be divided evenly between those enterprises to which the operation is directly chargeable. The sugar beet should bear a fair proportion of this cost. This cleaning does not require much time, consequently the total charge for any given farm is small. In some cases the operation includes both man labor and horse labor; on other farms the work involves hand labor only. Frequently a plow may be used to advantage in removing the accumulated silt from the bottom of the lateral. A V-shaped machine is sometimes substituted for or used after the plow. The ditching is usually performed a few weeks before it is necessary to make a run of water. In procuring these estimates on ditching practice, only such work as the operator applied directly to the beets was put into the record. The data with reference to ditching were tabulated in two classes, the first including those farms where man labor only was involved, the second embracing the work which required both man labor and horse labor. Some growers did a part of the ditching with man and horse labor and completed the task with hand labor only.

One hundred and forty-five reports contained information relative to the use of man labor only in connection with ditching practice. A few farmers in the Provo and Garland districts cleaned the ditches twice during the season. However, on the majority of these farms the work was done but once. The Garland records showed that 2.07 man hours were expended per acre, involving a cost of 41 cents. The Provo estimates gave 1.86 man-hours per acre with an attendant cost of 35 cents, while Idaho Falls growers devoted 1.01 hours to ditching at a cost of 20 cents per acre.

Eighty-six records reported on ditching practice with both man labor and horse labor. The ditches were cleaned once during the season. The man labor varied from one-third to six-tenths of an hour per acre, and the horse labor ranged from eight-tenths of an hour to 1.19 hours per acre. The Garland estimates reported the maximum time for this operation, while the minimum requirement was given for the Idaho Falls growers. The Provo labor for ditching was slightly higher than that of Idaho Falls. At Garland the cost amounted to 24 cents per acre; at Provo, 17 cents; and Idaho Falls, 16 cents per acre.

COMMERCIAL FERTILIZERS.

These materials are not used extensively in the irrigated districts of the west. Occasionally this item of cost enters into the farm record, but as a rule very few men buy and apply commercial fertilizers in the intermountain country, especially for the improvement of the beet land. The records for 1914–15 did not indicate that any commercial materials had been purchased.

PLANTING.

In the beet-growing districts of Utah it is customary for the factories to own and operate the beet drills. Usually the planting is not done by the individual grower, but by some party employed by the sugar company to do this work on a number of farms within a given area. The men engaged for this purpose usually have small farms and are therefore in a position to do some outside work. There are several advantages in this arrangement. It is very evident that the man who operates a drill for several days in succession can do a better grade of work than the man who plants a 6 or 10 acre tract which requires a fraction of a day or at most not more than a full day per year. Furthermore, the small farmer is not required to carry an investment in a piece of machinery which is used only a few hours each year. A direct charge of 50 cents per acre is made to cover the planting and the rent of the drill. Beet seed is sold to the farmers at the rate of 15 cents per pound, and about 15 pounds per acre are planted. A few growers used slightly less than 15 pounds per acre, while some exceeded the standard quantity. The farmer hauls the seed from the factory or warehouse to the farm. This work is done at a season of the year when the fields do not require attention, or is made a secondary feature of some special trip to town. The item of hauling seed is cared for under the heading "Overhead charges."

The operators who did their own planting gave estimates on this practice, and the results are reported in Table XIV.

TABLE XIV.—*Planting practice.*

District.	Year.	Number of farm records.	Acres. planted per farm.	Hours per acre.		Total cost per acre.
				Man.	Horse.	
Garland	1915	5	22.80	0.74	1.48	$0.28
Provo	1914–15	8	21.38	.89	1.78	.35
Idaho Falls	1915	24	19.50	.92	1.84	.37

The rows are uniformly 20 inches apart. In each district the crews consisted of one man and two horses (fig. 5). It will be noted that the estimates for Garland and Provo were limited to a few farms. Sixty-six per cent of the growers at Idaho Falls reported on planting. The work was done in the same manner as in the other districts. Ten to thirteen acres constituted an average day's work. By comparing the farm rate for planting in these three districts with the contract price, which was 50 cents per acre, it will be seen that the cost was 22, 15, and 13 cents per acre less for the respective areas than the contract price for this work. The difference may be considered as the charge for the use of the drill.

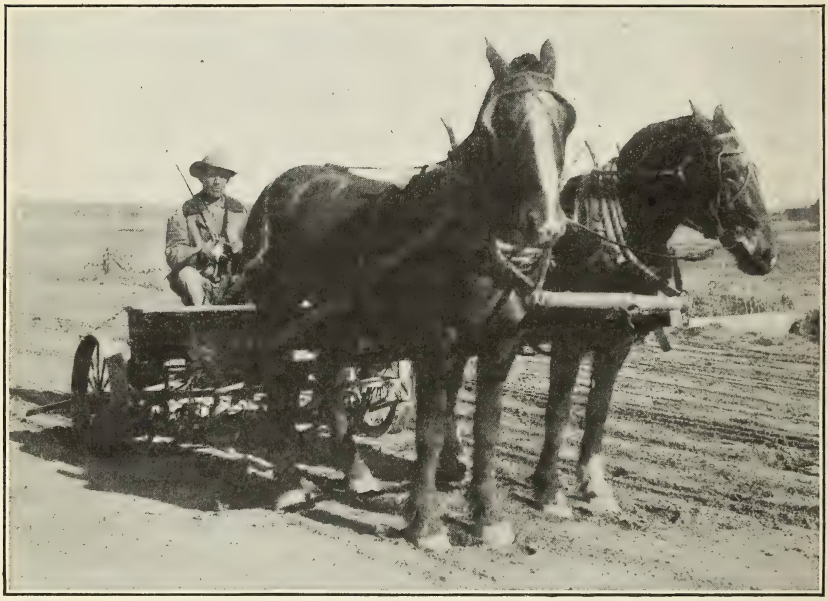

FIG. 5.—Putting in beet seed with a 4-row drill. For this operation the crew consists of one man and two horses.

CULTIVATING.

Intertillage should begin early. The beet crop is cultivated from three to seven times, depending upon soil conditions and area under cultivation. Usually all of the cultivation is completed before irrigation; in a few cases the two operations overlapped. Blocking and thinning proceed simultaneously with cultivation; however, the discussion of hand labor will not be taken up by parts but will be considered as a whole. (See Table XV.)

TABLE XV.—*Cultivating practice.*

District.	Year.	Number of farm records.	Acres cultivated per farm.	Times cultivated.	Average crew.		Hours per acre.		Total cost per acre.
					Man.	Horse.	Man.	Horse.	
Garland	1914–15	73	18.14	3.78	1	1.88	4.24	7.54	$1.53
Provo	1914–15	58	14.36	4.66	1	1.41	6.98	9.20	2.25
Idaho Falls	1915	35	20.30	3.97	1	2.00	3.88	7.40	1.52

Regular beet cultivators were used in these areas. At Garland and Idaho Falls the number of cultivations averaged approximately four. The Provo estimates gave an average of 4.6. Sixty-eight records in the Garland districts indicated the use of a four-row cultivator (fig. 6), which was operated by crews consisting of one man and two horses. Similar crews were reported in connection with 22 Provo estimates, and for 34 farms at Idaho Falls. There were 13 estimates at Garland and 34 at Provo which showed the use of a two-row cultivator, the crews in this case being one man and one horse. The Provo district had the largest number of two-row cultivators. (See Table XVI.)

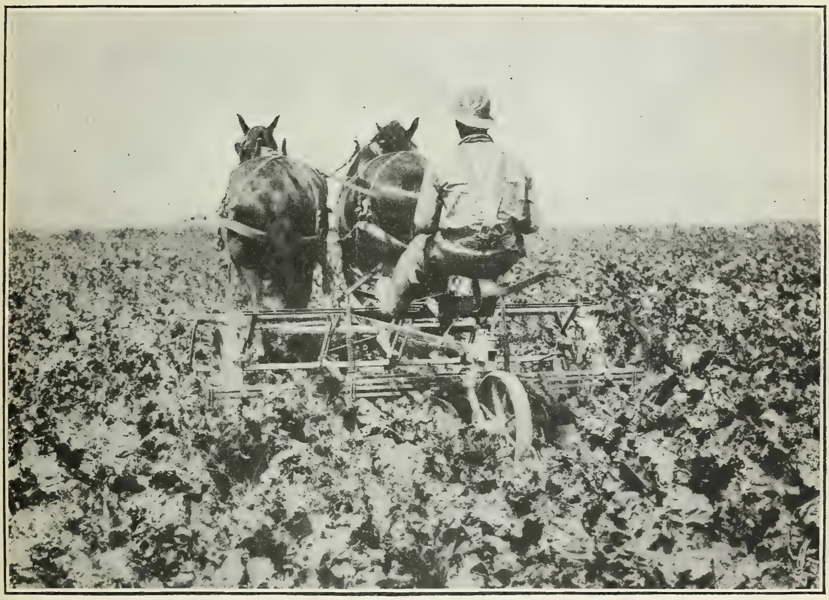

FIG. 6 (A).—Cultivating sugar beets with a crew of one man and two horses. This type tills the soil between four rows.

TABLE XVI.—*Average time and cost of cultivating with 2 and 4 row implements.*

Implement.	Crew.		Number of records.	Per cent of records.	Acres cultivated.	Times cultivated.	Hours per acre.		Total cost per acre.
	Man.	Horse.					Man.	Horse.	
2-row cultivator	1	1	46	27.7	11.29	4.44	7.74	7.74	$2.24
4-row cultivator	1	2	120	72.3	19.07	3.87	4.09	8.18	1.56

The 4-row cultivator, with its crew of one man and two horses, assisted in reducing the number of man hours expended per acre, and this in turn was the factor which lowered the total cost per acre. It may not be advisable to maintain a 4-row cultivator for every farm, but it ought to be possible to own and use such a cultivator cooperatively. The necessary horsepower is available on practically all farms.

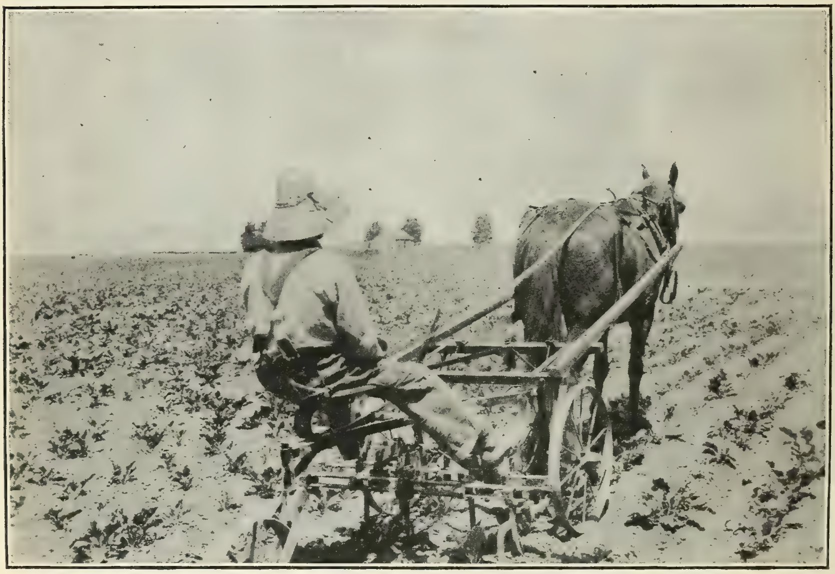

FIG. 6 (B).—Cultivating sugar beets with a crew of one man and one horse.

FURROWING.

Furrowing out is done to open up furrows between the beet rows prior to irrigation. There is a striking correspondence between the furrowing out and the cultivation practice in these three districts. This work is usually performed after the last cultivation. Special attachments which take the place of the regular teeth are provided with each beet cultivator. On many farms it is the custom to run the water between every other row, alternating with each irrigation, and these are the spaces which require special attention at the completion of the last cultivation. There are other cases where the water is run between every row. As a rule it is not necessary to furrow out more than once; however, in these three groups this number was exceeded in some cases. Provo estimates averaged one and one-half times. Naturally the various types of machines represented in cultivation practice appeared again in this work. (See Table XVII.)

TABLE XVII.—*Furrowing practice.*

District.	Year.	Number of farm records.	Acres furrowed per farm.	Average crew.		Hours per acre.		Total cost per acre.
				Men.	Horse.	Man.	Horse.	
Garland	1914–15	73	18.14	1	1.85	1.14	2.05	$0.41
Provo	1914–15	54	14.36	1	1.44	1.82	2.43	.59
Idaho Falls	1915	35	20.3	1	2.00	1.03	1.97	.40

The size of crew and type of implement were undoubtedly the features which determined the greater expenditure of labor and the higher cost for furrowing-out shown in the Provo district.

IRRIGATION.

Irrigation, which is the artificial application of water to the land, requires only man labor. It has been pointed out that the precipitation for Utah is exceedingly light; consequently a crop like the sugar beet can not usually be brought to maturity without resorting to irrigation. Now and then lands may be found which will produce good crops of beets without irrigation, or it may be that the crop is carried to maturity with one irrigation only. Such lands are usually located so that they receive the benefit of seepage water from a near-by canal, or they may obtain the season's supply from an adjacent lake or reservoir. The irrigation season extends from June to September. (See Table XVIII.)

TABLE XVIII.—*Irrigation practice.*

District.	Year.	Number of farm records.	Acres irrigated per farm.	Number of times irrigated.	Man Hours per acre.	Total cost per acre.
Garland	1914–15	73	17.59	3.71	6.89	$1.38
Provo	1914–15	55	14.06	3.89	7.16	1.36
Idaho Falls	1915	36	20.40	4.10	8.40	1.68

The labor requirements for irrigation in the Garland and Provo districts were quite similar, and the total cost per acre was approximately the same. At Idaho Falls slightly more time was spent irrigating each acre of land, resulting in an increased cost of 30 cents per acre. It is possible that the difference in cost may be explained by the fact that the Yakima loam did not retain the water as well as did the Jordan loam, necessitating a large number of applications, and thereby requiring more time per acre to do this work. (See figs. 7 and 8.)

BLOCKING AND THINNING.

Sufficient beet seed is usually drilled in the row to give more plants than are required, provided a good germination is obtained. As soon as the plants are large enough to distinguish the rows, the blocking and thinning are done. The blocking, which means chopping out surplus plants with a hoe, leaves small clusters of beets 10 to 12 inches apart in the row. The thinning, which is done by hand, takes out the surplus plants in each cluster, thereby leaving the proper number of beet plants in the row. On the small farm the operator, with the assistance of other members of the family, does this part of the work. The blocking is done with a hoe which averages about 6 inches in width. The small bunches of beets were left about 10 to 12 inches apart in the row in the Garland and Provo districts. At Idaho Falls the estimated distance was about 14 inches. The laborer has instructions to leave the strongest and most vigorous plants, and these are disturbed as little as possible. When this precaution is not observed it usually takes the young plants a few days to recover from the setback they receive. A perfect stand can be obtained only by exercising care at this stage of the cultivation of the crop.

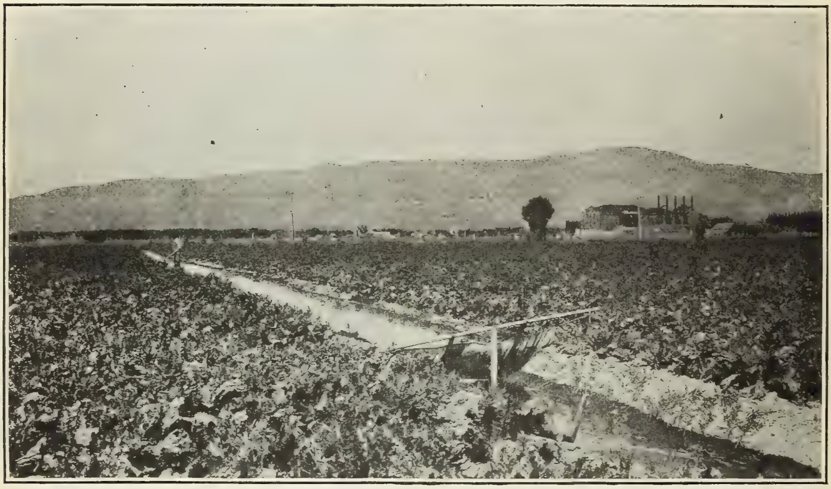

FIG. 7.—Making openings along the field laterals in order to irrigate sugar beets on portion of field to left of large stream of water. A canvas dam may be seen in the foreground.

The handwork with sugar beets may be considered from the standpoint of contract labor covering all the items in question, or it may be discussed from the viewpoint of the farmer who does a part or possibly all of the handwork. The actual cash outlay furnishes a very reliable check on any estimates which may be given by men who make a practice of doing their own handwork. (See Table XIX.)

TABLE XIX.—*Comparative cost of blocking and thinning.*

District.	Year.	Number of farm records.	Acres blocked and thinned per farm.	Hours per acre.	Cost per acre.
Garland	1914–15	32	14.82	21.32	$4.26
Provo	1914–15	13	9.23	23.43	4.45
Idaho Falls	1915	17	11.6	23.72	4.74

The difference in the labor requirements for blocking and thinning in Provo and Idaho Falls districts was exceedingly small. The Garland reports placed this requirement more than two hours per acre less than for the other areas. The customary contract price for this work was $6 per acre at Garland and Idaho Falls and $5 at Provo.

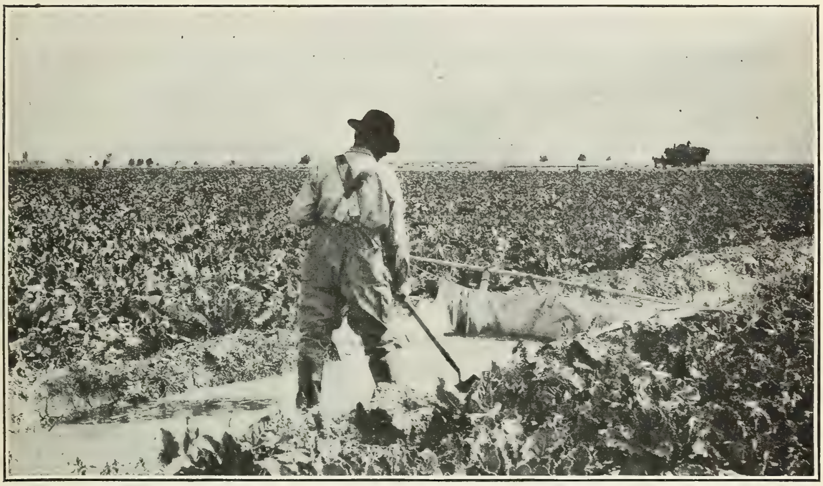

FIG. 8.—Making a new set in a field lateral. A canvas is laid down in the ditch with the free edge toward the approaching stream of water, and soil is thrown upon the canvas for the purpose of holding it in place.

HOEING.

The hoeing is done during the early summer months. Under ordinary conditions the fields are hoed twice. Where a contract is involved, the laborer agrees to keep the field free from weeds. This means hoeing the beets twice, and occasionally some weed pulling is necessary later in the season. In 1915, 77 estimates were secured on the first hoeing, and the average time varied from 9 to 11.5 hours per acre, with costs ranging from $1.79 to $2.18 per acre. There were 74 records for the same season on the second hoeing. The labor for the second hoeing varied from 5.7 to 8.1 hours per acre, involving costs of $1.14 to $1.54 per acre. Eleven growers in the Provo district reported on a third hoeing. The labor in this case amounted to 5.6 hours per acre, with a cost of $1.12 per acre. Weeding was shown on 15 records, 13 of which came from Provo. The cost for this work was 88 cents per acre.

TABLE XX.—*Comparative contract prices for hand labor.*

Kind of work.	District.		
	Garland.	Provo.	Idaho Falls.
Blocking and thinning	$6.00	$5.00	$6.00
First hoeing	2.50	2.50	2.50
Second hoeing	1.50	1.75	1.50
Topping and loading 12 tons	7.80	7.20	10.00
Total	17.80	16.45	20.00

Certain growers made a practice of doing a part of the handwork themselves, the remainder of this labor being done by contract. In the Garland and Provo districts several operators contracted the blocking and thinning, also the pulling and topping, but most of the hoeing was done by the family. The contract prices which were paid in these areas varied considerably. (See Table XX.) The usual price for blocking and thinning at Provo was $5 per acre, while pulling and topping cost 60 cents per ton. At Garland $6 per acre was the customary price for blocking and thinning, and the prevailing rate for pulling and topping was 65 cents per ton. A few growers contracted hand labor on a tonnage basis at $1.65 to $1.90 per ton. On the other hand, a few paid a flat price of $21 per acre for a 12-ton yield, making provision for a bonus of 50 to 75 cents per ton in cases where the yield exceeded the stipulated return. At Idaho Falls the general practice included the payment of $20 per acre for a 12-ton yield, with a bonus of 60 cents per ton for each increment of 1 ton. Where the yield falls below 12 tons per acre, the grower has the privilege of deducting 50 cents for each ton below the yield stated in the agreement.

Frequently the topping is done directly from the row of standing beets, while in other cases the beets are pulled and placed in piles, from which the topping is done. It should be stated that the lifter loosens the beet in the soil so that the roots can be taken out readily by hand. For some districts the topping, especially when placed on a contract basis, included some work loading beets from the field piles. The cost per acre at the usual contract rates is somewhat higher than the average cost given by the growers who did this work themselves. Seventy-seven estimates were obtained on pulling and topping practice, and the results are shown in Table XXI.

TABLE XXI.—*Topping practice.*

District.	Year.	Number of farm records.	Acres topped per farm.	Tons per acre.	Man hours per acre.	Cost per acre.	Cost per ton.
							Cents.
Garland	1914–15	29	15.34	14.74	23.48	$4.70	31.9
Provo	1914–15	37	14.10	14.82	28.61	5.44	36.7
Idaho Falls	1915	11	14.10	10.9	27.92	5.58	51.2

The estimated cost of pulling and topping at Garland was 31.9 cents per ton, as compared with 65 cents per ton on a contract basis. The average estimated cost per ton at Provo was 36.7 cents per ton, the usual contract price paid for the same work being 60 cents. Idaho Falls growers estimates were 51.2 cents per ton, as compared with a contract rate of 83.3 cents, where the yield was 12 tons per acre.

LIFTING.

The harvest season begins late in September and frequently extends well into the month of November. As the harvest season approaches, the field men gather samples of beets from the different fields. Laboratory tests on these beets indicate the sugar content and the coefficient of purity and determine when the beets are ready to pull. The 1-row lifter was used uniformly in these three districts. The lifting is done at the same time as the hauling. On many farms the operator does this work during the early part of the day, enough beets being loosened to keep the toppers busy for the remainder of the day. When not employed at this task the lifting crew hauls beets to the loading station. On the larger farms it is customary to keep one crew busy lifting. (See Table XXII.)

TABLE XXII.—*Lifting practice.*

District.	Year.	Number of farm records.	Acres lifted per farm.	Average crew.		Hours per acre.		Total cost per acre.
				Man.	Horse.	Man.	Horse.	
Garland	1914–15	69	17.99	1	3.04	4.71	14.31	$2.23
Provo	1914–15	56	14.52	1	2.48	5.98	14.69	2.61
Idaho Falls	1915	35	19.20	1	2.90	4.66	13.48	2.28

In the Garland district there were 58 reports, based upon crews containing 1 man and 3 horses. Idaho Falls growers on 32 farms used similar crews. At Provo the estimates were about equally divided between 1-man and 2-horse and 1-man and 3-horse crews, there being 29 of the former and 27 of the latter. The cost per acre was 37 cents greater at Provo than at Garland. For these districts a day's work varied from 1.67 to slightly more than 2 acres.

HAULING.

The hauling season coincides with the harvesting season. When the latter begins late in September or early in October, the greater part of this work will be completed by the end of November. The sugar beet is a bulky and heavy product to handle, hence good wagons with substantial racks are an important part of the grower's equipment. Ample horsepower must also be provided to haul the beets from the field to the dump, slicing station, or factory. Formerly many of the sugar beets were unloaded by hand, but under present conditions this work is done mechanically. When the soil is soft an extra team may be required in the field for the purpose of assisting the regular crew to haul the loads to a solid roadbed. (See Table XXIII.)

TABLE XXIII.—*Hauling practice.*

District.	Year.	Number of farm records.	Tons per acre.	Average crew.		Hours per acre.		Total cost per acre.	Cost per ton.
				Man.	Horse.	Man.	Horse.		
									Cents.
Garland	1914–15	75	14.60	1	3.50	11.96	42.61	$6.22	42.6
Provo	1914–15	58	15.10	1	2.93	14.35	40.20	6.75	44.9
Idaho Falls	1915	30	13.50	1	3.67	8.71	31.87	4.93	36.5

One hundred and sixty-three farm reports were secured on hauling practice. A few growers hired the beets hauled. The price for hauling on contract varied from 35 cents to 75 cents per ton. The customary price appeared to be 50 cents per ton for a haul of one and one-half miles. In the accompanying record this rate varied from 36.5 cents per ton for the Idaho Falls group to 44.9 cents per ton for the Provo group. Forty-three farm reports in the Garland area indicated the use of one man and four horses in this operation. Practically all of the remaining Garland records were applicable to a 1-man and 3-horse crew. The Provo reports included 19 crews with one man and four horses, 16 with one man and three horses, and 23 with one man and two horses. At Idaho Falls the usual crew consisted of one man and four horses.

The distance between the beet fields and the loading station naturally has an influence on the cost of delivery. It will be seen that in marketing a crop like sugar beets, where the yield from 1 acre weighs 12 to 15 tons, the product of a single acre will require several trips with one wagon; and if there is a long haul ahead of the operator the cost of handling the crop will be much greater than it is on the farm which has a loading station nearby. This relationship is shown in Table XXIV.

TABLE XXIV.—*Relation of distance from loading station to cost of delivering the sugar beet.*

Group.	Distance.	Average distance.	Number of farm records.	Average crew.		Average cost per ton.
				Man.	Horse.	
	Miles.	*Miles.*				
1	1½ or less	0.93	79	1	3.22	$0.370
2	1½ to 3	2.31	62	1	3.31	.446
3	3 to 4½	3.93	19	1	3.78	.550
4	Over 4½	5.30	3	1	4.00	.610

Practically all of the men who gave estimates on hauling are classified in the first three groups. By comparing group 1 with group 3, it will be seen that the cost per ton was 18 cents greater in the latter than in the former. With a yield of 15 tons per acre, this would mean a cost of $2.70 per acre above that of the minimum average haul.

COST OF PRODUCING SUGAR BEETS.

The cost figures in this summary are classified under three headings, viz, (1) labor, (2) materials, and (3) other costs. This compilation covers the total number of acres harvested. These data are therefore applicable to the total beet acreage as reported in 79 Garland, 58 Provo, and 36 Idaho Falls records. The Garland estimates included a total of 1,461 acres of beets. Provo had 833 acres, and Idaho Falls 735 acres. The total cost for each district was calculated for these acreages. Dividing the total sum of all costs in each district by the number of acres grown therein gave the cost per acre for each section. The cost of producing a ton of sugar beets in the respective areas was determined by dividing the total of all costs by the total number of tons marketed. A weighted average is therefore represented in the final result.

LABOR COSTS.

Labor comprises operator's labor, horse labor, and contract labor. By adding these together the total labor cost for each district was obtained. (See Table XXV.)

TABLE XXV.—*Labor costs.*

District.	Year.	Number of farm records.	Total acres in beets.	Cost per acre.	Cost per ton.
Garland	1914–15	79	1,461	$40.18	$2.71
Provo	1914–15	58	833	38.08	2.54
Idaho Falls	1915	36	735	35.29	2.59

The labor cost for the Idaho Falls area was approximately $5 per acre less than the amount reported in the Garland estimates. When reduced to the average cost per ton, the lowest figure was shown for the Provo group—namely, $2.54 per ton. It will be recalled that the contract rate which prevailed at Idaho Falls was $20 per acre. This is 57 per cent of the total labor cost.

COST OF MATERIALS.

Cost of materials includes the value of the manure in the yard, money spent for the purchase of manure on a few farms, expenditures for beet seed, and water assessments. (See Table XXVI.)

TABLE XXVI.—*Cost of materials.*

District.	Year.	Number of farm records.	Total acres in beets.	Cost per acre.				Cost per ton.
				Manure.	Seed.	Water.	Total.	
Garland	1914–15	79	1,461	$3.62	$2.21	$0.93	$6.76	$0.45
Provo	1914–15	58	833	4.22	2.24	.49	6.95	.46
Idaho Falls	1915	36	735	3.52	2.18	1.47	7.17	.53

Manure.—Each grower gave an estimate of the value of manure used, thus furnishing a basis for computing the manure charge. There was a slight difference in the rate of application for the respective districts. The Idaho Falls group shows the lowest rate of application per acre and the lowest charge. The Garland group shows the highest average application of manure, but the highest manure charge is for the Provo area. It should be observed, however, that the total manure charge was distributed over a relatively large acreage in the Garland district. The area manured per farm was also less than in the Provo district.

Seed.—The common practice in these areas was to plant beet seed at the rate of 15 pounds per acre. The seed was sold to the grower at 15 cents per pound, making a total charge of $2.25 per acre. A few farmers in the groups studied used less than 15 pounds of seed per acre, the average cost varying from $2.18 to $2.24 per acre. These rates are a fraction below the standard charge.

Water.—The farms in the Garland area invariably showed a uniform charge of $1 per acre for water assessments. This group, however, contained some rented farms. In such cases the water assessments were not paid by the operator, but were included in the rent. With these farms eliminated, the average rate is lower than $1 per acre. In the Provo district a number of growers obtained their irrigation water from artesian wells. This feature had a tendency to reduce the number of men who paid water assessments on a given ditch, and the rate per acre is consequently comparatively low for this area. The average water assessments reported for the Idaho Falls district was 98 cents per acre higher than that for the Provo district.

The Garland rate was intermediate between those for the other areas. Taking all such expenses into account, it will be seen that there is very little difference in the three districts.

OTHER COSTS.

"Other costs" are charges which apply to the farm as a whole. They must therefore be distributed so that each enterprise will carry its proper proportion of the general expenses. Such items as insurance, taxes, interest on land, land rent, machinery charges, and miscellaneous expense constitute this list. (See Table XXVII.)

TABLE XXVII.—*Other costs.*

District.	Year.	Number of farm records.	Total acres in beets.	Cost per acre.					Cost per ton.
				Insurance and taxes.	Interest and rent.	Machinery.	Miscellaneous expense.	Total.	
Garland	1914–15	79	1,461	$1.16	$16.09	$3.41	$1.43	$22.09	$1.49
Provo	1914–15	58	833	1.95	17.77	3.49	1.35	24.56	1.65
Idaho Falls	1915	36	735	1.67	13.28	4.00	1.27	20.22	1.48

Insurance and taxes.—Figures covering farm insurance and taxes, and an estimate of the total real-estate investment and the value of the beet land per acre, were obtained from each operator. From these data the investment in beet land was computed, and from this the percentage the beet-land investment is of the total real-estate investment. Then, by taking this percentage of the total farm insurance and taxes, the charge against sugar beets was readily ascertained. This method was employed where the operator was the owner of the land. Where the operator was a renter, the insurance and taxes were usually small. The operators in the respective districts were mostly owners. The insurance and taxes varied from $1.16 per acre in the Garland area to $1.95 per acre in the Provo section.

Interest and rent.—Every farm owner has a given amount of capital invested in land, and this money should bring a reasonable return each year. If the prevailing rate of interest is 8 per cent per annum, it will be apparent that a land valuation of $200 per acre should bring an interest return of $16 per acre. This interest is chargeable against the crop grown upon the land during the season. Since, on the farms studied, the beet land was given a higher valuation than other lands, sugar beets assumed a greater proportion of the interest cost than the remaining crop enterprises. Land rent is directly related to interest charges; however, it should be observed that the share or cash payment not only covers interest on the investment in such land, but also takes care of land taxes and insurance. This item was $1.68

per acre greater at Provo than at Garland. Idaho Falls growers were $4.49 below the highest average interest and rent charge.

On farms where the greater part of the hand labor is on a contract basis it is the custom for the sugar company to advance to the operator sufficient money to pay approximately one-half of the total cost of hand labor as soon as the thinning and hoeing have been completed. The amount of this loan, with interest, is deducted from the beet receipts in the autumn. This interest is a part of the cost of raising beets, and it has been so charged in this study.

Beet machinery cost per acre.—In computing the cost for machinery it is necessary to consider not only the interest on the original investment which was required to furnish field equipment for the production of sugar beets, but also depreciation and annual repairs. A part of the equipment used in the preparation of beet land is required in caring for other crops; hence the annual charge against these implements must be distributed as equitably as possible over the enterprises involved. These items were calculated and compiled as machinery charge. The method employed in securing the essential data in 1914 differed somewhat from the plan which was followed in 1915. The former plan gave a slightly lower charge than the latter, and the fact that the records for 1914 were confined to Provo and Garland explains in part why Idaho Falls has the maximum machinery cost. The difference between Garland and Idaho Falls was only 59 cents per acre. By comparing the machinery charge with other costs in this classification, or with the total cost of production, it will be observed that the equipment cost constitutes only a minor part, and any small modification one way or the other would not appreciably change the final results.

Miscellaneous expense.—There are certain other costs which are not chargeable to any one enterprise in particular, but have to be carried by the whole farm, and a certain part must fall upon each enterprise. To make provision for these items a 3 per cent charge was assigned on the basis of the labor and material costs combined. If the labor and materials amounted to $50 per acre, 3 per cent of this sum would be $1.50. The latter would then be counted as a part of the total cost of producing the crop. There is a difference of 16 cents between the Idaho Falls group and the average which was obtained from the Garland estimates.

SUMMARY OF COSTS.

TABLE XXVIII.—*Summary and distribution of costs.*

District.	Year.	Cost per acre.	Cost per ton.	Percentage distribution of costs.		
				Labor.	Materials.	Other costs.
Garland	1914–15	$69.03	$4.65	58.3	9.6	32.1
Provo	1914–15	69.59	4.65	54.4	10.0	35.6
Idaho Falls	1915	62.68	4.60	56.3	11.5	32.2

The average yield per acre for the 79 Garland reports was 14.85 tons; the 58 Provo records gave essentially the same average; while in the Idaho Falls district 36 farms showed an average return of 13.62 tons per acre. The cost per acre was $69.03 for the Garland area, slightly more for the Provo farms, and considerably less for the Idaho Falls group. There was very little difference in the cost per ton in the three areas. (See Table XXVIII.)

Labor is by far the largest item of expense in producing sugar beets. It constitutes from 54.4 to 58.3 per cent, or slightly more than half of the total cost. The purchase of materials takes approximately 10 per cent of the total amount, while other costs constitute about 33 per cent of the entire expense of production.

After the total costs had been determined these figures were compared with the returns from the crop. The total returns include not only the amount received for the beets, but also the value of the tops. (See Table XXIX.)

TABLE XXIX.—*Average returns and margin above cost in producing sugar beets, 1914–15.*

District.	Yield per acre.	Received per acre.	Cost per acre.	Net returns, beets per acre.	Total net returns per acre including tops.
	Tons.				
Garland	14.85	$74.40	$69.03	$5.37	$7.60
Provo	14.96	74.20	69.59	4.61	6.85
Idaho Falls	13.62	69.46	62.68	6.78	9.23

The receipts per acre for sugar beets depend upon the yield per acre and the price paid per ton. The yields were almost identical for the Garland and Provo sections, but the average for Idaho Falls was slightly less. There was practically no difference in the price paid per ton in the three districts.

LABOR REQUIREMENTS.

The labor requirements in producing sugar beets comprise three groups—namely, man, horse, and contract labor. Since it is a general practice to hire certain operations done at a stipulated price per acre or ton, the contract labor is always given in money values. In order to obtain the total man-labor requirement for the three districts under consideration, this cash outlay for contract work has been changed to its equivalent in man hours by dividing through with a rate of 25 cents per hour. The hours of man labor reported in Table XXX represent the total man labor necessary in the production of an acre of sugar beets under the conditions that obtained in this investigation.

TABLE XXX.—*Labor required in producing an acre of sugar beets.*

District.	Number of records.	Acreage grown.	Average yield per acre.	Hours of man labor.	Hours of horse labor.
Garland	79	1,461	14.85	133.3	98.5
Provo	58	833	14.96	130.8	117.14
Idaho Falls	36	735	13.62	119.4	79.3

The Provo and Garland districts have essentially the same man-labor requirements. Idaho Falls operators produced an acre of sugar beets with 11 to 14 less man hours than growers in the companion districts. It is of interest to note that the contract labor in the Provo area was about one-third that of the other areas. The major portion of the hand labor at Provo was performed by the farmer and his family and, as has been previously pointed out, was accomplished at a lower cost than would have been possible if done on a contract basis. This practice is feasible only where the farm units are small. In the other districts the farms are larger than at Provo.

The fewest horse hours were necessary at Idaho Falls and the most at Provo. This difference was due partly to the difference in acreage in beets in the different areas. More efficient use was made of horse labor on the larger beet tracts. The average acreage per farm in beets was 14.36 at Provo, 17.94 at Garland, and 20.40 at Idaho Falls. Larger crews were used in the Garland and Idaho Falls regions than at Provo, and this had a tendency to reduce the horse-labor requirement per acre.

VALUE OF TOPS.

More attention is being given annually to a better utilization of beet tops. This by-product is considered quite important by many growers. Other men attach very little value to them. In view of the fact that there is quite an appreciable waste under certain methods of handling beet tops, it is not surprising that opinions on the value of this feed should vary widely.

The field estimates in Utah and Idaho dealing with this subject can be divided into three distinct groups. On many farms the tops were fed to the live stock owned by the operator. The estimated valuation assigned on these farms was based upon the probable sale price of feeding stuffs which would be saved when tops were fed. Other growers in these districts sold the beet tops to cattle or sheep feeders, and the estimates in this instance were based upon the cash receipts for tops. The third group included those farmers who plowed the tops under. A few farms combined two of these methods in disposing of the beet tops. The per cent of farm estimates and the average value of the beet tops per acre under three methods of handling them are shown in Table XXXI.

TABLE XXXI.—*Disposition and estimated acre value of sugar beet tops.*

District.	Year.	Number of records.	Per cent fed.	Value when fed.	Per cent sold.	Value per acre when sold.	Per cent plowed under.	Value when plowed under.
Garland	1914–15	79	35	$2.48	19	$2.12	32	$1.77
Provo	1914–15	58	50	2.81	...	...	29	1.27
Idaho Falls	1915	36	61	2.31	31	2.82	...	...

A much lower estimated value was reported by the farmers who plowed under the tops than by the men who fed or sold this material. In the Garland district the average cash price received per acre was less than the average estimated value. The case was reversed in the Idaho Falls district, and the operator who sold obtained a higher price per acre than the estimated value which was given by those men who fed the tops to their own live stock.

BEET ACREAGE PER FARM AND YIELD PER ACRE IN RELATION TO COST.

The yield per acre is an important factor in making a study of costs. The number of acres planted per farm also appears to exert some influence upon cost of production. (See Table XXXII.)

TABLE XXXII.—*Costs in relation to acres in beets and yield per acre.*

Acres in beets.	10 tons or less per acre (cost).			11 to 15 tons per acre (cost).			16 tons and over per acre (cost).		
	Number of farms.	Per acre.	Per ton.	Number of farms.	Per acre.	Per ton.	Number of farms.	Per acre.	Per ton.
10 acres or less	12	$62.59	$8.65	17	$72.47	$5.53	29	$75.70	$4.12
11 to 20 acres	14	59.04	6.69	24	66.87	5.01	32	71.81	3.93
21 acres and over	8	60.20	6.22	18	64.70	4.85	19	70.19	4.02

Increasing the yield per acre made the total cost per acre greater, but each successive increase in yield reduced the cost per ton. It would seem that the grower who is producing 16 tons per acre either in small, medium, or comparatively large tracts can grow and market these beets at a much lower cost per ton than the man who gets only 10 tons per acre under similar conditions. With greater efficiency in a few of the major operations, higher yields would undoubtedly result, and this in turn would appreciably increase the margin above cost. It may be noted that, with the exception of one subgroup, the larger the area devoted to beets, the less the cost per ton for a given yield. Where 21 acres of beets and over were grown and a yield of 16 tons and over was produced, the cost per ton ($4.02) was slightly increased by a lower yield per acre than that reported for the preceding size group.

COMPARISON OF BEET RECEIPTS WITH OTHER FARM RECEIPTS.

A comparison of the income from sugar beets with that from other farm enterprises sheds some light upon the importance of this crop, especially in the Provo and Garland areas. The information which was obtained upon the subject deals only with the crop year 1915. The average receipts per farm and the distribution of these receipts were obtained from 113 farms.

Table XXXIII.—*Beet receipts in comparison with other farm receipts.*

District.	Number of farm records.	Average total receipts per farm.	Per cent of total receipts from—				Per cent beet receipts are of total crop receipts.	Per cent receipts from potatoes are of total receipts.
			Crops.	Live stock.	Miscellaneous.	Beets.		
Provo	37	$2,542	54.1	43.4	2.5	41.8	77.2	....
Garland	40	2,471	70.1	25.1	4.8	44.5	63.5	....
Idaho Falls	36	4,873	64.8	34.1	1.1	29.4	45.3	24.4

A glance at Table XXXIII will show that the farms in these three districts were essentially crop farms. Approximately two-thirds of the returns from crops in the Provo and Garland districts came from sugar beets. This enterprise produced more than 40 per cent of the total farm receipts in the same areas. The lower returns from beets in the Idaho Falls section are due to competition with the potato. The receipts from potatoes and sugar beets combined were 53.8 per cent of the total receipts. The receipts from live stock in the Provo area came from dairy products, while at Idaho Falls these receipts were secured from sheep feeding.

RELATION OF YIELD TO COST OF PRODUCTION.

The accompanying frequency curve (Fig.9) shows the distribution of the operators in these three districts on the basis of cost per ton in producing beets.

It will be seen that the 173 operators who gave estimates may be divided into two groups, each including about an equal number of men. There were 89 men who produced sugar beets at a cost of $4.50 per ton or less, while 84 men raised sugar beets at a cost of $5 or more. The average cost for all farms was $4.64 per ton. The factories in these two districts paid from $4.85 to $5 per ton for sugar beets during the years 1914 and 1915.

It may be well to repeat, for the sake of emphasis, that the growers who produced the highest average yield per acre had the lowest cost per ton, whereas the men who obtained the lowest average yield had the highest cost per ton recorded against the crop. The yield per acre has a direct bearing upon the cost per ton.

On practically every farm there are places where the field work can be put upon a more efficient basis. Every grower is willing to concede that some slight change in present operations would probably be a step in the direction of greater crop yields. It has been pointed out that the sugar beet is not always grown in the regular cropping system. Continuous culture may, therefore, be holding down the yields; in other cases, a lack of fertility may be the controlling factor, although in all of these districts nearly every grower gave considerable attention to the application of farm manure. Inadequate preparation of soil or careless seeding may give poor stands. This precludes the possibility of a good yield. Furthermore, the blocking and thinning may be done in such a way as to interfere seriously with the stand. These are points which should be kept in mind throughout the season, and if there are weak places in the present methods of farm management, these should be corrected as far as possible.

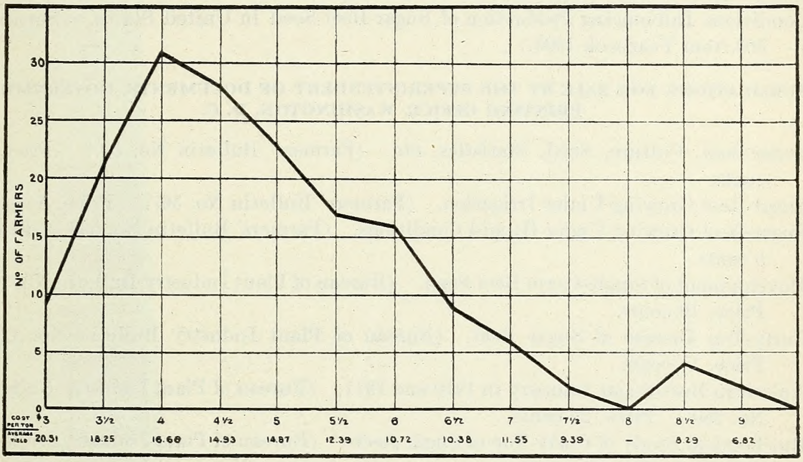

FIG. 9.—Frequency curve showing distribution of operators on basis of cost of beets per ton.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE RELATING TO THE PRODUCTION OF SUGAR BEETS.

PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION BY THE DEPARTMENT.

Profits in Farming on Irrigated Areas in Utah Lake Valley. (Department Bulletin No. 117.)

Loss in Tonnage of Sugar Beets by Drying. (Department Bulletin No. 199.)

Leafspot: A Disease of Sugar Beets. (Farmers' Bulletin No. 618.)

Control of the Sugar-Beet Nematode. (Farmers' Bulletin No. 772.)

Sugar-Beet Sirup. (Farmers' Bulletin No. 823.)

The Use of Windmills in Irrigation in the Semiarid West. (Farmers' Bulletin No. 866.)

Curly-Top of Beets. (Bureau of Plant Industry Bulletin No. 181.)

Conditions Influencing Production of Sugar-Beet Seed in United States. (Separate 503 from Yearbook 1909.)

PUBLICATIONS FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C.

Sugar-Beet, Culture, Seed, Statistics, etc. (Farmers' Bulletin No. 52.) Price, 5 cents.

Sugar-Beet Growing Under Irrigation. (Farmers' Bulletin No. 567.) Price, 5 cents.

Sugar-Beet Growing Under Humid Conditions. (Farmers' Bulletin No. 568.) Price, 5 cents.

Development of Single-Germ Beet Seed. (Bureau of Plant Industry Bulletin No. 73.) Price, 10 cents.

Curly-Top Disease of Sugar Beet. (Bureau of Plant Industry Bulletin No. 122.) Price, 15 cents.

American Beet-Sugar Industry in 1910 and 1911. (Bureau of Plant Industry Bulletin No. 260.) Price, 25 cents.

Biochemical Study of Curly-Top of Sugar Beets. (Bureau of Plant Industry Bulletin No. 277.) Price, 5 cents.

Comparative Tests of Sugar-Beet Varieties. (Bureau of Plant Industry Circular No. 37.) Price, 5 cents.

Progress Report of Beet-Sugar Industry in United States in 1909. (Report No. 92.) Price, 10 cents.

Analyses of Sugar Beets 1905–1910 With Methods of Sugar Determination. (Bureau of Chemistry Bulletin No. 146.) Price, 10 cents.

Report of Irrigation Investigations in Utah. (Office of Experiment Stations Bulletin No. 124.) Price, 90 cents.

Irrigation in Idaho. (Office of Experiment Stations Bulletin No. 216.) Price, 15 cents.

Utilization of Residues from Beet-Sugar Manufacture in Cattle Feeding. (Separate 137 from Yearbook 1898.) Price, 5 cents.

Relation of Sugar Beets to General Farming. (Separate 320 from Yearbook 1903.) Price, 5 cents.